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TRANSMITTAL FORM

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Total Number of Pages in This Submission: 20

Application Number	10/771,267
Filing Date	February 2, 2004
First Named Inventor	Justin K. Brask et al.
Art Unit	2822
Examiner Name	Christy L. Novacek
Attorney Docket Number	P15744C

ENCLOSURES *(Check all that apply)*

- [✓] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
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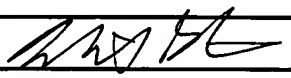
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [✓] Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) (please Identify below):

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Intel Corporation		
Signature			
Printed name	Michael D. Plimier		
Date	May 9, 2006	Reg. No.	43,004

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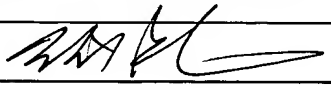
Signature			
Typed or printed name	Michael D. Plimier	Date	May 9, 2006

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Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2006

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500.00

Complete if Known	
Application Number	10/771,267
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Examiner Name	Christy L. Novacek
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METHOD OF PAYMENT (check all that apply)

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1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fees Paid ($)**
Utility	300	150	500	250	200	100	0
Design	200	100	100	50	130	65	0
Plant	200	100	300	150	160	80	0
Reissue	300	150	500	250	600	300	0
Provisional	200	100	0	0	0	0	0

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims	Extra Claims	Fee ($)	Fee Paid ($)
20 - 20 or HP =	0	x 50	= 0

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims	Extra Claims	Fee ($)	Fee Paid ($)
2 - 3 or HP =	0	x 200	= 0

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	
Fee ($)	**Fee Paid ($)**
360	0

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
0 - 100 =	_____	/ 50 = _____ (round up to a whole number)	x _____	= 0

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	0
Other (e.g., late filing surcharge): Appeal Brief	500.00

SUBMITTED BY

Signature		Registration No. (Attorney/Agent) 43,004	Telephone 408-75-7857
Name (Print/Type)	Michael D. Plimier		Date May 9, 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Justin K. Brask, et al.

Serial No.: 10/771,267

Filed: February 2, 2004

For: **A METHOD FOR MAKING A SEMICONDUCTOR DEVICE HAVING A HIGH-K GATE DIELECTRIC**

Art Unit: 2822

Examiner: Novacek, Christy L.

Attorney Docket: P15744C

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Applicant submits this brief in support of Applicants' appeal from a final decision of the Examiner in the captioned case.

TABLE OF CONTENTS

(i) *Real party in interest.*

The real party in interest is the assignee, Intel Corporation.

(ii) *Related appeals and interferences.*

There are no known related appeals and / or interferences.

(iii) ***Status of claims.***

Claims 1-26 (Canceled)

Claims 27-34 (Rejected)

Claims 35-38 (Canceled)

Claims 27-34 are rejected and are the subject of this Appeal Brief.

(iv) ***Status of amendments.***

All filed amendments have been entered. The attached claims appendix reflects the current status of amendments as of the date of this appeal.

(v) ***Summary of claimed subject matter.***

The patent application is concerned with removing impurities from a high-k gate dielectric layer, and increasing the oxygen content of that layer. As deposited, a high-k gate dielectric layer may be incompatible with polysilicon due to the presence of impurities and oxygen vacancies (Specification, page 5, lines 14-16). By removing impurities and increasing the oxygen content, the resulting high-k gate dielectric layer may be compatible with polysilicon or another material used to make a gate electrode (Specification, page 5, line 22 through page 6, line 2).

Claim 27 recites a method for making a semiconductor device. A high-k gate dielectric layer (110, Figure 1a) is formed on a substrate (100, Figure 1a) (Specification, page 3, lines 17-18). The high-k gate dielectric layer comprises impurities and oxygen (Specification, page 5, lines 14-16). The high-k gate dielectric layer is exposed to a solution that comprises hydrogen peroxide (Specification, page 6, lines 3-13). This exposure is for a sufficient time at a sufficient temperature to remove impurities from the high-k gate dielectric layer and to increase the oxygen content of the high-k gate dielectric layer (Specification, page 6, lines 5-9). Sonic energy is applied while the high-k gate dielectric layer is exposed to the solution (Specification, page 8, lines 8-11). A gate electrode (130, Figure 1c) is then formed on the high-k gate dielectric layer (Specification, page 10, lines 3-4).

(vi) ***Grounds of rejection to be reviewed on appeal.***

I. Are claims 27-31 unpatentable over Visokay et al. (U.S. Pub. 2003/0045080) in view of Boyd et al. (U.S. 6,845,778)?

II. Are claims 32 and 34 unpatentable over Visokay in view of Boyd and Ahn et al. (U.S. Pub. 2004/0043569)?

III. Is claim 33 unpatentable over Visokay in view of Boyd and Ahn?

(vii) *Argument.*

I. The rejection of independent claim 27 under 35 U.S.C. § 103(a) as being unpatentable over Visokay in view of Boyd is in error and should be reversed

Claim 27 recites that a high-k gate dielectric layer is exposed to a solution that comprises hydrogen peroxide at a sufficient temperature for a sufficient time to remove impurities from the high-k gate dielectric layer and to increase the oxygen content of the high-k gate dielectric layer. Claim 27 also recites that sonic energy is applied during that exposure. By removing the impurities and increasing the oxygen content, the resulting high-k gate dielectric layer may be compatible with polysilicon (Specification, page 5, line 22 through page 6, line 2).

Because there is no motivation to combine the cited references to result in the method of claim 27, the rejection is in error and should be overturned. A proper prima facie rejection under 35 U.S.C. 103(a) requires a suggestion or motivation within the cited prior art or within the knowledge generally available to one of ordinary skill in the art to combine references or modify a reference (MPEP 706.02(j), 2143; *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)). The cited references do not provide such a suggestion or motivation to combine them to result in the method recited in claim 27.

Visokay is concerned with oxidizing material of a high-k dielectric layer (*see*, Visokay, paragraphs [0012], [0024], and [0029]) to remove defects such as oxygen vacancies (Visokay, paragraph [0024]). Visokay is not merely cleaning a surface of a substrate; it is concerned with chemically altering a layer via an oxidation reaction (Visokay, paragraph [0024]).

Boyd, in contrast, is concerned with cleaning particles from a surface of a substrate (*see*, Boyd, col. 1, lines 6-9). Boyd indicates that megasonic energy is useful to remove particles from a surface (Boyd, col. 1, lines 25-27). However, Boyd does not disclose applying megasonic energy, "at a sufficient temperature for a sufficient time to remove impurities ... and to increase the oxygen content of the high-k gate dielectric layer," as is recited in claim 27. Nor is there any indication in Boyd that the megasonic energy would also be useful when chemically altering a high-k dielectric layer, as described by Visokay, or when removing impurities from a layer or increasing the oxygen content of that layer, as recited in claim 27.

Boyd is concerned with cleaning foreign particles from a surface. Visokay is concerned with chemically altering the material of a layer. As the references are concerned with different processes, one of skill in the art would not be motivated to combine the two to result in the method recited in claim 27. The rejections are unsupported in the art and should be overturned.

The Examiner's statement in the paper mailed March 3, 200, that Boyd contains ample disclosure of the usefulness of megasonic energy in a cleaning step, is not relevant to either claim 27 or Visokay, and do not support the rejection. Neither claim 27 nor Visokay are concerned with cleaning particles from a surface of a substrate. Rather, claim 27 recites a high-k layer that comprises impurities, and removing at least some of those impurities. Visokay is concerned with chemically altering a high-k layer by an oxidation reaction. As Visokay is not concerned with cleaning, one of skill in the art would not take Boyd's statements of the usefulness of using megasonic energy in a cleaning step as motivation to combine Boyd with Visokay.

Claims 28-31 depend from claim 27. The rejections of claims 28-31 should be overturned for the same reasons provided above with respect to claim 27.

II. The rejection of claims 32 and 34 under 35 U.S.C. § 103(a) as being unpatentable over Visokay in view of Boyd and Ahn are in error and should be reversed

Claims 32 and 34 depend from claim 27. As stated above, Visokay and Boyd fail to disclose or suggest the method recited in claim 27. Ahn fails to rectify this deficiency. The rejection is in error and should be overturned.

III. The rejection of claim 33 under 35 U.S.C. § 103(a) as being unpatentable over Visokay in view of Boyd and Ahn is in error and should be reversed

Claim 33 depends from claim 27. As stated above, Visokay and Boyd fail to disclose or suggest the method recited in claim 27. Ahn fails to rectify this deficiency. The rejection is in error and should be overturned.

Further, claim 33 recites that the impurities permeate through the high-k gate dielectric layer. This makes it even more clear that one of skill in the art would not be motivated to use the surface-cleaning method of Boyd to remove such impurities.

CONCLUSION

For the foregoing reasons, applicant respectfully requests the Board to vacate the examiner's rejections of claims 27-34, to remand this application to the Examiner, and to direct the Examiner to pass this case to issuance.

Respectfully submitted,

Date: May 9, 2006

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(viii) ***Claims appendix.***

1. – 26. (canceled)

27. A method for making a semiconductor device, comprising:

forming a high-k gate dielectric layer on a substrate, the high-k gate dielectric layer comprising impurities and oxygen;

exposing the high-k gate dielectric layer to a solution that comprises hydrogen peroxide at a sufficient temperature for a sufficient time to remove impurities from the high-k gate dielectric layer and to increase the oxygen content of the high-k gate dielectric layer;

applying sonic energy while the high-k gate dielectric layer is exposed to the solution that comprises hydrogen peroxide; and then

forming a gate electrode on the high-k gate dielectric layer.

28. The method of claim 27, wherein sonic energy is applied at a frequency of between about 10 KHz and about 2,000 KHz, while dissipating at between about 1 and about 10 watts/cm^2.

29. The method of claim 28, wherein sonic energy is applied at a frequency of about 1,000 KHz, while dissipating at 5 watts/cm^2.

30. The method of claim 27, wherein the solution that comprises hydrogen peroxide is an aqueous solution that contains between about 2% and about 30% hydrogen peroxide by volume, and wherein the high-k gate dielectric layer is exposed to the aqueous solution at a temperature that is between about 15°C and about 40°C for at least about one minute.

31. The method of claim 30, wherein the aqueous solution contains about 6.7% hydrogen peroxide by volume, and wherein the high-k gate dielectric layer is exposed to the aqueous solution for about 10 minutes at a temperature of about 25°C.

32. The method of claim 27, wherein the impurities in the high-k gate dielectric layer comprise chlorine.

33. The method of claim 32, wherein the impurities permeate through the high-k gate dielectric layer.

34. The method of claim 32, wherein the high-k gate dielectric layer is exposed to the solution that comprises hydrogen peroxide at a sufficient temperature for a sufficient time to remove at least 80% of the chlorine from the high-k gate dielectric layer.

35. – 38. (canceled)

(ix) ***Evidence appendix.***

As the record and this appeal do not rely upon any evidence submitted under 37 CFR 1.130, 1.131, or 1.132, no evidence is listed herein. The record and this appeal only rely upon the record itself, the patent code (35 U.S.C.), the patent rules (37 CFR), the MPEP, case law, and the cited references.

(x) ***Related proceedings appendix.***

As stated in section (ii), above, there are no known related proceedings.

FIRST CLASS CERTIFICATE OF MAILING

(37 C.F.R. § 1.8(a))

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Michael D. Plimier
Name of Person Mailing Correspondence

Signature

May 9, 2006
Date